THE BELL INEQUALITY (Proof)

Form $\gamma_n = a_n b_n + a_n b_n' + a_n' b_n - a_n' b_n'$

$(= a_n(b_n + b_n') + a_n'(b_n - b_n'))$

So $\gamma_n = \pm 2$

Hence $\left|\frac{1}{N}\sum_n \gamma_n\right| = \left|\frac{1}{N}\sum_n a_n b_n + \cdots - \frac{1}{N}\sum_n a_n' b_n'\right| \leq 2$

or $|C(a,b) + C(a,b') + C(a',b) - C(a',b')| \leq 2$

where correlation coefficient

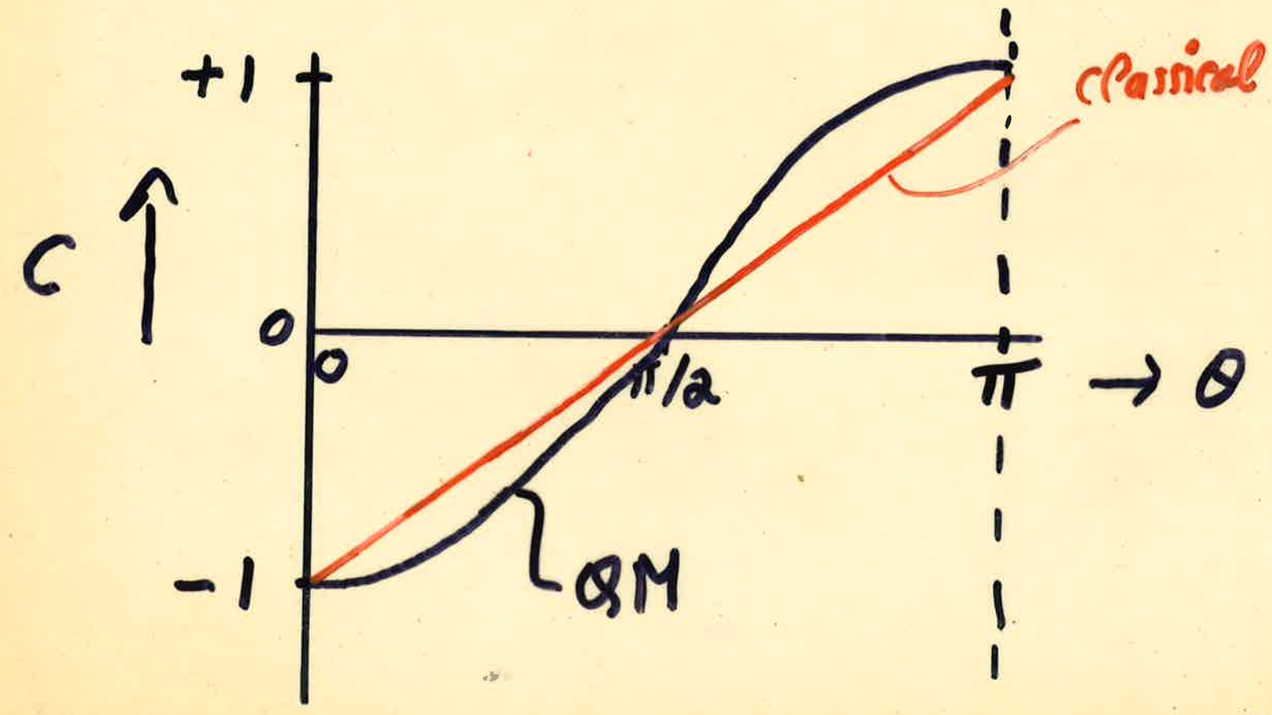
$C(a,b) = \frac{1}{N}\sum_n a_n b_n$, etc.

For QM

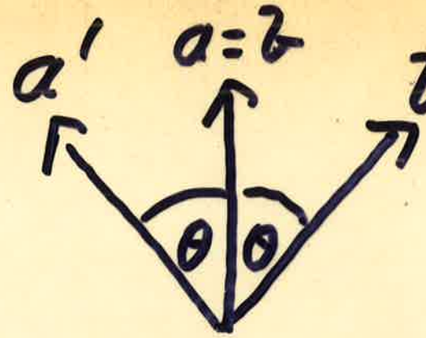
$$C(a,b) = -\cos\theta_{ab}$$
$$\simeq -1 + \tfrac{1}{2}\theta_{ab}^2 \cdots$$

Compare

$$C_{\text{classical}}(a,b) = -1 + \frac{2\theta_{ab}}{\pi}$$



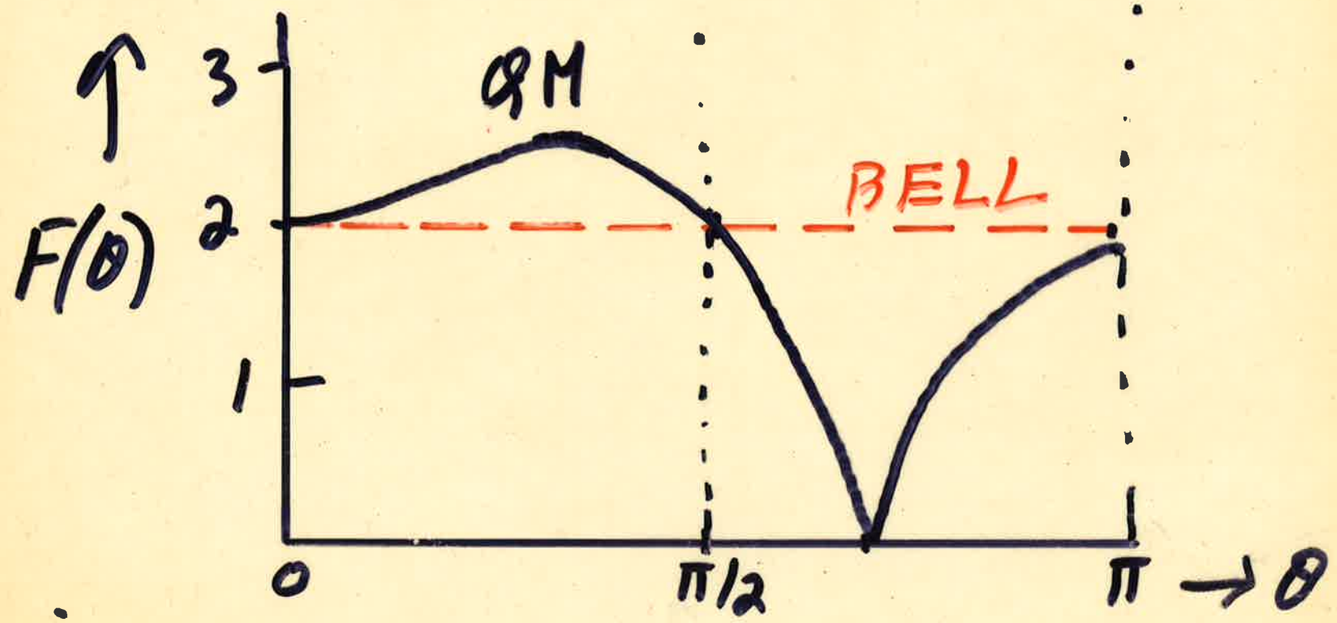
Take



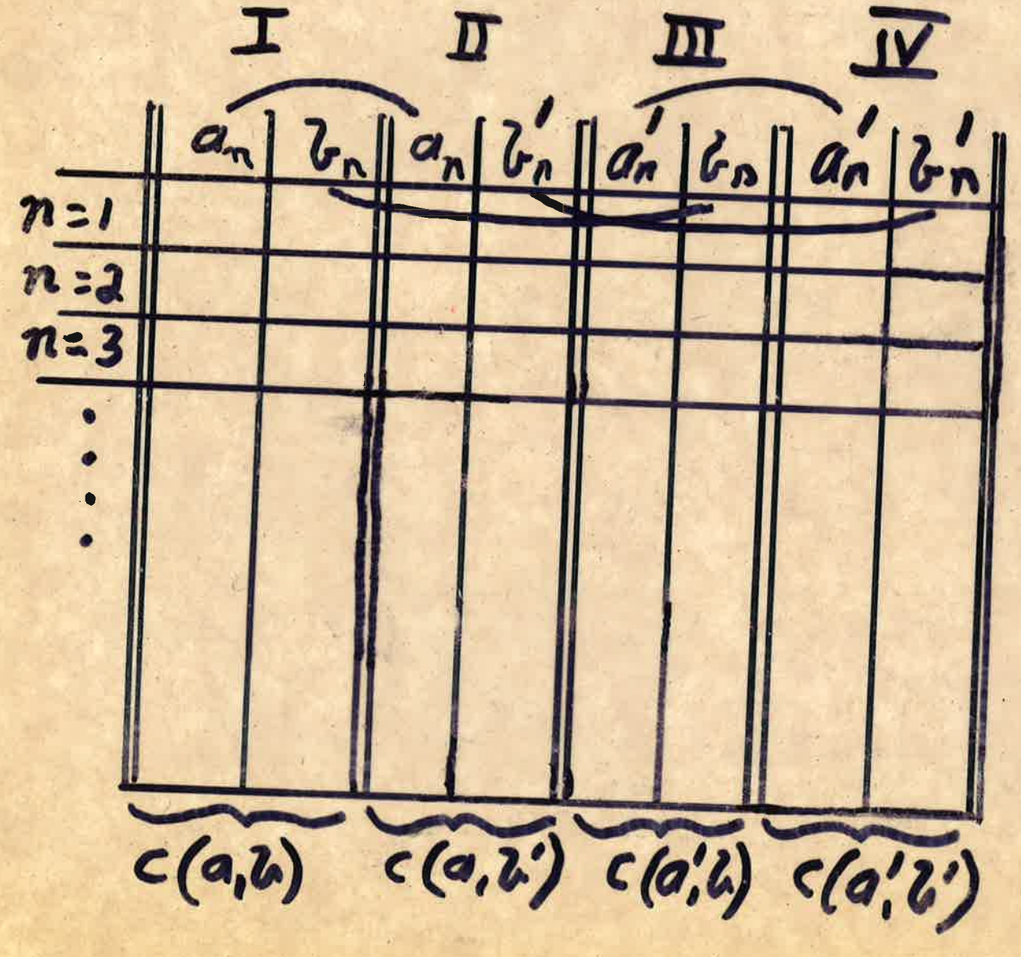
Consider $F(\theta) = |C(a,b) + \cdots|$

$= |1 + 2\cos\theta - \cos 2\theta|$

≤ 2 ?

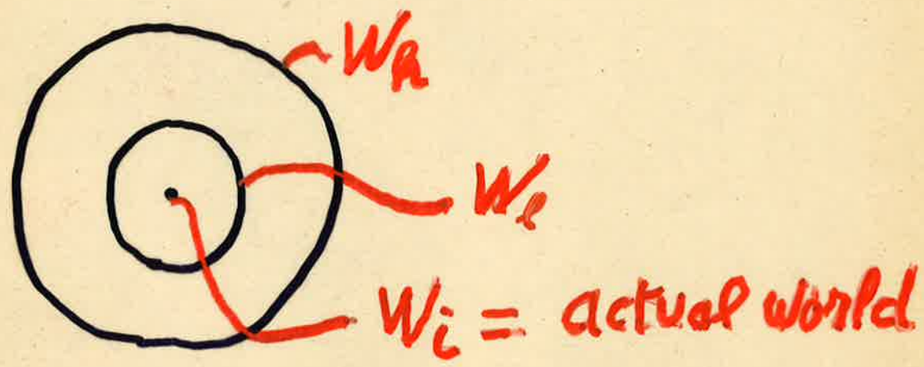


THE FOUR CORRELATION EXPERIMENTS



TRUTH CONDITIONS FOR

$\phi \;\Box\!\!\rightarrow\; \psi$



$$\exists W_R \Big[\exists W_e \big((W_e \leq_i W_R) \wedge W_e(\phi) \big) \wedge \forall W_s \big((W_s \leq_i W_R) \rightarrow (W_s(\phi) \rightarrow W_s(\psi)) \big) \Big]$$